forms. The present paper describes a large and beautiful calci-sponge, originally described by Mr. Carter as *Trichonella labyrinthica*, but better located in the genus Grantia as defined by Vosmaer. It is very large for a calcareous sponge, well-grown specimens being about three inches in height and a little more in breadth. In adult forms there is a stout cylindrical stem surmounted by a greatly convoluted cup-shaped mass. Into the detailed description it would be impossible to enter; but in regard to the recent controversy about the existence of "Sollas's membrane" it may be mentioned that in this species this membrane remains visible even when the collars of the cells are retracted, thus indicating that it is probably a more or less permanent structure, and no mere temporary fusion of the margins of adjacent collars. As to the family Teichonidæ, it must be abandoned, and this branch of Lendenfeld's genealogical tree has to be cut off. (4) On the flagellated chambers and ova of *Halichondria panicea* (plate v.). In this study the minute structure of the above portions of this common British sponge are described from specimens killed with osmic acid. In this sponge the collared cells, when the chamber is seen in section, stand some little distance apart from each other. They have short nucleated bodies, surmounted by delicate funnel-shaped collars; these are all connected at their margins by a very distinct membrane, and the flagella of the collared cells were seen plainly projecting through the collars and into the cavity of the chamber; thus the question of the co-existence of Sollas's membrane and the flagella is settled. The ovum possesses a nucleus with a nuclear membrane and nucleolus, and it is suspended by a pedunculated envelope in the lacuna.—On *Megascolex cæruleus*, Templeton, from Ceylon; together with a theory of the course of the blood in earthworms, by Dr. A. G. Bourne (plates vi. to ix.). During a short visit in 1889 to Ceylon the author obtained thirty-eight species of earthworms; only seven of these have been found in India, and about twenty-nine Indian species have not yet been found in Ceylon. The author summarizes his theory of the circulation as follows: the vascular system consists of a portion in the cephalized region, and of other portions metamerically repeated in all succeeding segments. The cephalized portion differs only from that occurring in any other segment in having undergone a synthesis, and also in the presence of contractile hearts. Throughout the body, blood is forced from the contractile vessels into the peripheral networks; thence it is conveyed by a system of intestino-tegumentary vessels to intestinal capillaries, and from these it returns to the contractile vessels.—On a little-known sense-organ in Salpa, by A. B. Lee (plate x.). This organ, mentioned and figured by Ussow in 1876, seems not to have been since alluded to; Ussow's figures are very imperfect. The organ appears to be either a taste bulb, or as the author inclines to think, "a sensory areometer or hydrometric apparatus."—Immunity against Microbes (Part 1*a*), by M. Armand Ruffer.

Bulletin de la Société des Naturalistes de Moscou, 1890, No. 1.—Ornithological fauna of the Amu-daria region, from Tchardjui to Kelif, by M. Zarudnoi. The monograph mentions 159 species of birds, of which 138 nest within the region itself (116 in its cultivated part, 37 in the neighbouring desert, and 25 in towns). Hardly ten more species can be found which nest in the region. Many of the enumerated species are very scarcely represented. The deserts in the north of the Amu have almost the same bird-fauna as the Transcaspian region, although they differ as to their amphibians and reptiles; while further north, in Khiva, M. Bogdanoff found, as known, a much richer bird-fauna, probably due to the proximity of Lake Aral. The enumeration of species is accompanied by short notes relative to their habitats and feathering; some measurements are also given.—The system of chemical elements, by B. Tchitchérine (in French). This most valuable work, the importance of which was pointed out by Prof. Mendeleeff in his Faraday Lecture, is summed up for the *Bulletin*. The researches of the author into the numerical laws of the system bring him to a most interesting hypothesis relative to the structure of simple bodies; it evidently cannot be dealt with in a short note.—Studies as to the development of Amphipods, Part 4, by Mme. Marie Rossiiskaya-Koschewnikowa, being the history of development of the *Sunamphitoë valida*, Czerniawski, and the *Amphitoë picta*, Rathke (in French, with plates).—The Cladoceræ of the neighbourhood of Moscow, by Paul Matile (in German, with plates). The species *Daphnia dentata*, *Ceriodaphnia setosa*, and *Macrothrix borysthenica* are new.—Note on the Spongillidæ of the neighbourhood of Moscow, by W. Zykoff.

No. 2.—The Neocomian deposits of the Vorobievo Hills (near Moscow) by A. Pavloff (in French). The ferruginous sandstones and sands lodged between the Volgian (intermediate between Cretaceous and Jurassic) deposits and the ground moraine of the great ice-sheet are supposed to belong to the Cretaceous age, Wealdian, and Neocomian. The following fossils testify the Cretaceous age of the brown sandstone: *Olcostephanus* (*Ammonites*) *discofalcatus*, Lah.; *O. progrediens*, Lah.; *O. Decheni*, Röm. (not Weerth); and *Crioceras Matheroni*, D'Orbigny.—On the Turgaisk meteorite, by E. D. Kislakovsky. It was discovered by Kirghizes in 1888, when tilling the soil at Bish tube, in the Nikolaevsk district of the province of Turgai, and consisted of two pieces—one about 70 pounds and the other about 36 pounds. The bigger one was bought by M. Nazaroff, who discovered also a third fragment (205 grammes) which was found some 3 feet north of the preceding. It has been given to the Moscow Society, and M. Kislakovsky's paper (illustrated by one plate) contains the results of its chemical analysis.—A catalogue of Lepidoptera of the Kazan province; Part 1, Rhopalocera, by A. Krulikovski (in Russian). The Lepidoptera of Kazan are very interesting, no fewer than 144 species of diurnal butterflies being already described by the author.—The *Tomicus Judeichii*, Kirsch., by Th. Teplouchoff (in German, with a plate). Its supposed identity with *T. duplicatus*, Sahlb., is discussed. Though formerly considered as a Uralian species, it has now been found all over middle Russia, as far as Courland.—On the history of development of *Hydrodictyon utriculatum*, Roth., by A. Artari (in German, with a plate).—Zoological researches in the Transcaspian region (continued), by N. Zarudnoi. Thirty-six species of reptiles and three amphibians are mentioned, and the catalogue of Mammalia and birds is completed according to observations made in 1889.

SOCIETIES AND ACADEMIES.

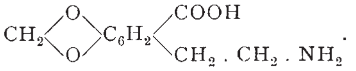
LONDON

Physical Society, January 16.—Prof. W. E. Ayrton, F.R.S., President, in the chair.—The thanks of the meeting were unanimously accorded to the Maxwell Memorial Committee for presenting to the Society a copy of Maxwell's scientific papers.—Prof. G. M. Minchin read a paper on Photo-electricity. His experiments on the subject were commenced in 1877, in attempting to produce a photographic image of a distant object. The result sought for has not hitherto been obtained, but the experiments have led to the discovery of many interesting phenomena. Some of these were shown to the meeting. Electric currents are produced by the action of light on silver plates coated with collodion or gelatine emulsions of bromide, chloride, iodide, or other silver salts, or with eosine, fluorescine, and other aniline dyes, when the plates are immersed in a suitable liquid and one plate illuminated whilst the other is screened. The directions of the currents depend on the materials employed, and the blue end of the spectrum is most effective. Currents have a photographic effect on the plates, and this action is strictly confined to the parts through which the current has passed. Comparatively strong currents were obtained from plates coated with eosine and gelatine. A curious reversal was observed with some cells, the exposed plate first being positive to the screened one, and almost immediately afterwards became negative. On shutting off the light, a transient increase of current resulted, and afterwards disappeared gradually. M. Becquerel, who has studied the action of silver plates coated with bromide, &c., concludes that the nature of the exposed plate (whether positive or negative) depends on the thickness of the surface layer. The electromotive force of such cells rarely exceeds $\frac{1}{20}$ of a volt. Uncleaned tinfoil plates in common tap water give a current when one is exposed to light and the other screened. Cleaning the plates destroys the effect. In nearly every case the exposed plate was first positive, and after a time became negative; and, by exposing various parts of a plate (some portions of which had been previously exposed), the currents could be varied in direction at will. These peculiarities may explain the known divergence of tin from Volta's law. The phenomena have also been studied by aid of the electrometer. Tinfoil obtained from tobacco packages was found to be very sensitive to light. One side of such foil is dull and the other bright, and, by pasting slips of it on opposite sides of a glass plate, so that dissimilar sides were outermost, and immersing them in alcohol, a cell giving an E.M.F. of $\frac{1}{10}$ volt when the dull side was exposed to light was obtained. The addition of any salt to the liquid, with a view to diminishing the resistance, invariably reduced the E.M.F. Experiment showed that the alcohols were by far the best liquids to use with tin plates. A process for producing very sensitive tin plates was described, which apparently results in the formation of white oxide of tin on the surface of the foil. With one such plate and another unsensitized plate the best results have been obtained by immersing them in methyl alcohol prepared from oil of wintergreen. From experiments on the variation of E.M.F. with the intensity of light, it was found that the square of the E.M.F. is proportional to the intensity. Some tin cells behave in a very peculiar manner, for it often happens that a good cell will exhibit no E.M.F. after being kept a few days. A slight impulse or tap given to the cell or its support restores the sensitiveness; another impulse makes the cell unsensitive, and these effects can be repeated indefinitely. Such cells the author calls "impulsion cells," and some were exhibited at the meeting. The sensitive plate of one of these cells had different properties at its two ends, for impulses had no effect on the nature of the lower end, but changed the upper end from positive to negative and *vice versâ*. Electro-magnetic impulses such as produced by sparks are capable of altering cells from the unsensitive to the sensitive state, but fail to produce the reverse effect; a Hertz oscillator restored the sensitive state in a cell placed at a distance of 81 feet away. The "impulsion effects" can be got rid of by renewing the alcohol on several successive days. During last year the author made some selenium cells by spreading the melted substance on metal plates and immersing them in liquids together with an uncoated plate. Of the various metals and liquids tried, aluminium and acetone gave the best effects. The process of forming these "seleno-aluminium cells" was described. One of their peculiarities is that they are nearly equally sensitive to rays of all colours; and when exposed to strong light may give an E.M.F. of $\frac{1}{2}$ to $\frac{2}{3}$ of a volt, the sensitized plate being negative. An arrangement of 50 cells in series with an electrometer was exhibited, whereby the E.M.F. generated by light falling on the cells could be caused to ring a bell, light or extinguish electric lamps, &c. In conclusion, the author pointed out the possible applications of photo-electricity to photometry, telephotography, and the utilization of solar energy. At the request of the President, Prof. Minchin promised to show the experiments on February 13, on which date the discussion on the paper is to take place.—Prof. F. R. Barrell exhibited and described a lecture-room apparatus for determining the acceleration due to gravity. A number of iron balls are allowed to fall through a certain height in such a way that one starts off when its predecessor arrives at its destination. From the time occupied by all the balls, the time for one can be found, and, knowing the distance traversed, *g* can be determined. The apparatus consists of two electro-magnets joined in series with a battery and key, together with a ball-feeding device. One of the magnets is vertically over the key and serves to catch the balls as they emerge from the feeding tube, whilst the other magnet actuates a kind of slide for supplying successive balls. When one ball falls on the key, it breaks circuit, and thus causes the first-mentioned magnet to let go its ball. The key then springs up again, thus making circuit; the feeding magnet then supplies another ball, which is caught by the holding magnet until the falling ball reaches the key, and the operations are repeated. Fairly accurate results can be obtained by the apparatus.—Sir John Conroy's paper on the change in the absorption spectrum of cobalt glass by heat was postponed.

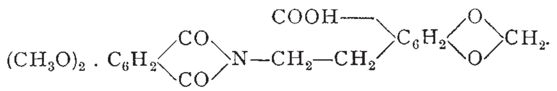
Anthropological Institute, January 27.—Anniversary Meeting.—Dr. John Beddoe, F.R.S., President, in the chair.—The following gentlemen were elected officers and Council for the ensuing year:—President: Dr. E. B. Tylor, F.R.S. Vice-Presidents: E. W. Brabrook, Hyde Clarke, and F. W. Rudler. Secretary: C. Peek. Treasurer: A. L. Lewis. Council: G. M. Atkinson, H. Balfour, C. H. E. Carmichael, Rev. Dr. R. H. Codrington, J. F. Collingwood, Dr. J. G. Garson, H. Gosselin, Sir Lepel Griffin, K.C.S.I., T. V. Holmes, H. H. Howorth, M.P., R. Biddulph Martin, Rt. Hon. the Earl of Northesk, F. G. H. Price, Charles H. Read, I. Spielman, Oldfield Thomas, Coutts Trotter, Sir W. Turner, F.R.S., M. J. Walhouse, General Sir C. P. Beauchamp Walker, K.C.B.

EDINBURGH.

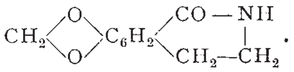
Royal Society, January 19.—The Hon. Lord Maclaren, Vice President, in the chair.—Prof. W. H. Perkin, Jun., read a paper on berberine. The alkaloid berberine, $C_{20}H_{17}NO_4$, yields, on oxidation with potassium permanganate, a number of substances, of which the more important are: oxyberberine, $C_{20}H_{17}NO_5$; dioxyberberine, $C_{20}H_{17}NO_6$; berberal, $C_{20}H_{17}NO_7$; anhydroberberilic acid, $C_{20}H_{17}NO_8$; and berberilic acid, $C_{20}H_{19}NO_9$. The study of these substances has given many results which afford a very clear insight into the constitution of the alkaloid. Anhydroberberilic acid dissolves in alkalies, forming a salt of berberilic acid; and this latter substance, when boiled with dilute sulphuric acid, is decomposed into hemipinic acid $(CH_3O)_2C_6H_2(COOH)_2$, and a new base, $C_{10}H_{11}NO_4$, which was shown to have the constitution



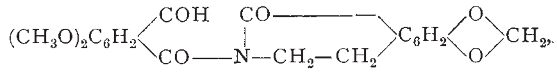
The constitution of anhydroberberilic acid is, therefore,



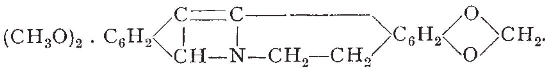
Berberal is decomposed by boiling with dilute sulphuric acid into pseudopianic acid, $(CH_3O)_2C_6H_2\left\langle\begin{array}{l}COH\\COOH\end{array}\right.$, and a substance, $C_{10}H_9NO_3$, which is the internal anhydride of the base, $C_{10}H_{11}NO_4$, described above, and which, therefore, has the constitution



The constitution of berberal is represented by the formula—



and the constitution of berberine is, probably,



A detailed account of these experiments has appeared in the Journal of the Chemical Society (1889, p. 63, and 1890, p. 992).—Dr. Thomas Muir read a paper on some hitherto unproved theorems in determinants. Symbols such as

$$\left|\begin{array}{cccccc} a_1 & a_2 & a_3 & a_4 & a_5 & a_6 \\ b_1 & b_2 & b_3 & b_4 & b_5 & b_6 \\ c_1 & c_2 & c_3 & c_4 & c_5 & c_6 \\ d_1 & d_2 & d_3 & d_4 & d_5 & d_6 \end{array}\right| = 0$$

indicate the vanishing of *all* the expressions whose vanishing is indicated by the component determinants

$$\left|\begin{array}{cccc} a_1 & a_2 & a_3 & a_4 \\ b_1 & b_2 & b_3 & b_4 \\ c_1 & c_2 & c_3 & c_4 \\ d_1 & d_2 & d_3 & d_4 \end{array}\right| = 0, \quad \left|\begin{array}{cccc} a_1 & a_2 & a_3 & a_5 \\ b_1 & b_2 & b_3 & b_5 \\ c_1 & c_2 & c_3 & c_5 \\ d_1 & d_2 & d_3 & d_5 \end{array}\right| = 0, \text{ \&c.}$$

Dr. Muir has proved directly that the law of multiplication of such symbols is the same as that of the multiplication of determinants, and he has applied this result to obtain the proof of various theorems in determinants which have been hitherto unproved, though known to be true.—Dr. Muir also discussed a problem of elimination connected with glissettes of the ellipse and hyperbola. Prof. Tait has proved that the glissettes of an ellipse, which slides on rectangular axes, can be obtained as glissettes of an hyperbola sliding on axes inclined to the former. The equation of the glissette, referred to the guides as axes, is obtained by the elimination of a variable quantity between two equations. In carrying out the elimination, Prof. Tait obtained an equation of the tenth degree. But Prof. Cayley had shown that the equation should be of the eighth degree; and therefore Prof. Tait's equation contained an extraneous factor. Dr. Muir has succeeded in determining this factor.—The Hon. Lord Maclaren read a paper on the equation of the glissette of the curve $\frac{x^n}{a^n} + \frac{y^n}{b^n} = 1$. He obtains two equations by elimination between which the equation of the glissette can be found.

PARIS.

Academy of Sciences, January 26.—M. Duchartre in the chair.—An isochronous pendulum, by the late Prof. Phillips. This was one of the last memoirs prepared by Prof. Phillips before his death. It contains a description of a method of rendering the oscillations of a pendulum perfectly isochronous by means of a small steel spring. M. Wolf has conducted a series of experiments with a view of testing the efficiency of the method, and has obtained very satisfactory results.—On the approximate representation of functions, by M. Emile Picard.—On a recent experiment in which the direction of vibration in polarized light is determined, by M. A. Cornu. A paper by Herr Wiener, contained in *Wiedemann's Annalen*, vol. xl. p. 203, 1890, is said to give the experimental solution of this problem. The method consists in letting a wide beam of polarized light fall upon a reflecting surface at an angle of 45°. As the beam is wide, there is a zone where incident and reflected rays cut one another at right angles; and if interference phenomena are produced in this zone, the direction of vibration of the polarized light must be normal to the plane of polarization and perpendicular to the direction of propagation. In order to find the nodes and ventral segments, M. Wiener has used an extremely thin photographic pellicle, so transparent that it will allow a free passage to the two waves which cross at its surface, and yet sensitive enough to receive impressions. By means of this exploring pellicle the existence of interference fringes has been made manifest.—Some facts relating to the history of the principal nitrogenous compounds contained in vegetable mould, by MM. Berthelot and G. André.—New observations on the volatile nitrogen compounds given off by vegetable mould, by M. Berthelot. An interesting fact brought out by the experiments is that the nitrogen contained in the volatile organic compounds given off under certain conditions by argillaceous sand is always much greater in amount than the nitrogen given off in the form of ammonia. The vegetable mould employed was twenty times richer in nitrogen than the argillaceous sand, but gave off the two classes of compounds in equal proportions.—Essay on the synthesis of proteid matters (peptones), by M. P. Schutzenberger.—On the influence of the recent cold period on some of the animals in the menagerie of the Muséum d'Histoire Naturelle, by M. A. Milne-Edwards. The author remarks on the acclimatization of various animals which are generally supposed not to be able to live through the cold experienced this past winter, and on the death from cold of indigenous animals living under the same conditions.—Observations of comets Zona and Brooks (II. 1890) made with the great equatorial of Bordeaux Observatory, by MM. G. Rayet and Picard. Observations for position were made on December 8 and 28, and on January 6, in the case of Zona's comet. Brooks's comet was observed on January 7, 9, 11, 14, and 15.—On the personal equation in transit observations, by M. F. Gonnessiat. Two instruments have been utilized in the observations, having apertures of 57 mm. and 135 mm. respectively. The "eye and ear" and the "electrical" method have been studied concurrently: and various objects, from nebulæ to the sun, have been observed. In the former method the greatest plus value of the personal equation was 0·13s. for planets from 90″ to 20″ in diameter (second edge), and the greatest minus value was 0·02s. for stars of about the ninth magnitude. For faint nebulæ observed in a dark field having faintly luminous cross wires, the value reached +0·30s.—Arithmetical theorems, by M. H. Minkowski.—A purely algebraic demonstration of the fundamental theorem of the theory of equations, by M. E. Amigues. The theorem is that every complete algebraic equation with real or imaginary coefficients admits of at least a real or imaginary root.—On the movements of a double cone rolling on two guides, by M. A. de Saint-Germain.—On the resistance of the air to the movement of a pendulum, by M. G. Defforges. Commandant Defforges has determined the law of variation of the time and amplitude of oscillations executed by pendulums employed in geodetic operations, in terms of the pressure of the surrounding fluid.—On Huygens's principle, by M. A. Potier.—A theorem having reference to the calculation of certain electrical resistances, by M. C. E. Guillaume. The author considers the effect of the plugs of a resistance-box upon the values of resistances derived from it.—Researches on the application of the value of rotatory power to the determination of the combinations formed by aqueous solutions of malic acid with white alkaline phospho-molybdates, by M. D. Gernez.—On the conductivities of isomeric organic acids and their salts, by M. Ostwald.—Reply to M. Ostwald's note, by M. Daniel Berthelot.—Electro-metallurgy of aluminium, by M. A. Minet. An ingot of aluminium was exhibited which had been obtained by the electrolysis of aluminium fluoride, with an electromotive force of about four volts.—Employment of the calorimetric bomb for the determination of the heat of combustion of coal, by M. Scheurer-Kestner.—The mordants employed in dyeing, and their relation to Mendeleeff's periodic law, by M. Prud'homme. The author establishes a relation between the shades of colour obtained by fixing dyes with different metallic oxides, and the atomic weight of the substance employed. The shades, therefore, vary in a manner which follows the periodic series of the elements.—Experimental researches on tetanus, by MM. Vaillard and H. Vincent.—Chemical theory of the coagulation of blood, by MM. M. Arthus and C. Pagès.—Note *à propos* of diabetes, by M. H. Arnaud.—On the development of muscular fibres, by M. Louis Roule.—The vision of Gastropods, by M. Victor Willem.—Influence of some internal causes on the presence of starch in leaves, by M. Emile Mer.—Contribution to the study of green Bacteria, by M. P. A. Dangeard.—Conclusions relative to the inclosures in the trachyte from Mont Dore, by M. A. Lacroix.—Influence of the nature of soil on the conduction of heat, by MM. Ch. André and J. Raulin.—On the barometric pressure at Naples at different altitudes, by M. Eugène Semmola.—A magnetic perturbation exactly coincident with the earthquake observed at Algiers on January 15, by M. Moureaux.—On the method of correction of temperature for the emergent stem of a mercury thermometer proposed by M. Guillaume, by M. Renou.

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